Some Propositions on Spacepower

NAVSTAR global positioning system satellite.

DOD

By MICHAEL V. SMITH

At the turn of the 21st century, spacepower remains on unsure theoretical and doctrinal footing. Despite more than forty years as the dominant actor in military space, the Air Force has not found a definitive way of conceptualizing space. It vacillates between the terms *aerospace* and *air and space* to describe operating environments beyond the earth's surface. Indeed, this distinction gives rise to heated debate among the members of two schools of thought. One holds that air and space operations form a single dimension of military power. The other sees them as separate and distinct.

Lieutenant Colonel Michael V. Smith, USAF, serves in the Air and Space Operations Directorate on the Air Staff and previously taught in the Space Division at the Air Force Weapons School.

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The case for airpower as an autonomous dimension of military power is convincing and generally understood; however, the same cannot be said of spacepower, especially inside the Air Force. The propositions that follow describe the nature of spacepower and serve as a foundation for a working spacepower theory.

Ten Propositions

Space is a distinct medium of operations. Space is physically separate and quite different from all earthly media. Orbital operations are constrained by the laws of physics, which creates a wall of misunderstanding between space professionals and those who do not understand orbital mechanics.

space professionals must centrally control spacepower to balance scarce resources across theaters

These physical qualities heavily influence operational methodologies and planning for space activities. Most important, space was cast diplomatically as a separate medium during the Eisenhower years. And the international community observes entirely different legal standards for space as well. Every U.S. administration has reaffirmed the belief that it is a separate and distinct operational medium.

The essence of spacepower is global access and global presence. The reason for moving earthly capabilities into orbit is exploiting the global nature of spacepower. Access to denied areas was the initial rationale for reconnaissance satellites, and it is still a compelling motivation. But the ability to conduct missions globally with limited assets is crucial not only for the military and civil sectors but also for the commercial world. In the vernacular of space, *global* means more than access to the entire surface of the earth, as airmen might use the term; it may mean access to all locations simultaneously, in war and peace, such as navigation and communications services.

Spacepower is comprised of a total national space activity. Activity in space outstretched its defense and intelligence roots as states developed civil and commercial sectors. Venturing into space is difficult, and a substantial infrastructure is required to generate programs. Spacefaring is most likely in the case of wealthy nations that have abundant natural resources, a stable political environment, a solid educational system that stresses the sciences, and the political will to make the commitment to a space program over the long term.

Spacepower must be centrally controlled by space professionals. Worldwide missions set off spacepower from other dimensions of military power. Because space assets operate globally, they cannot be managed on the theater level like land forces, which would handicap spacepower in the same way airpower was limited at the outbreak of World War II under the Army. Space professionals must centrally control spacepower to balance scarce resources across theaters. At the same time, space professionals must take charge of the battle for space control rather than leaving it to other commanders with different priorities.

Spacepower is a coercive force. The presence of space assets such as reconnaissance and surveillance satellites influences and will increasingly influence actors who seek to conceal certain activities. This situation arises from the deterrent potential of collection assets that are designed to serve as national technical means of treaty verification. Some actors are likely deterred from certain actions in the presence of spy satellites. Increasingly, spacepower assets are integrating into the sensor-to-shooter loop of combat operations. This development, plus the emergence of weapons in orbit, signals the expansion of spacepower for compellence as well as deterrence.

Many actors can exploit commercial space assets. Commercial vendors who sell military-related space products constitute a new breed of mercenary. Any asymmetric advantage held by the superpowers based on their space prowess is eroding because anyone who can pay the tariff can obtain space support. Military and law enforcement planners must take into account the potential for an enemy to exploit these capabilities.

Spacepower assets form a national center of gravity. More and more segments of society turn to space-based assets, which makes the relatively few satellites in orbit lucrative targets for an enemy with the means to strike them. Although access to satellites is seldom a single point of failure, losing access to the vital information they collect and carry will increase the fog, friction, and cost of operations, which could turn the tide against spacefaring states.

Space control is not optional. A growing reliance on spacepower assets by governmental agencies and the business community makes it essential to secure access to satellite services. It is equally important to deny access to unfriendly users. Because an enemy is likely to compete for relative control of the space medium, states must take measures to secure national interests.

Space professionals require career-long specialization. Spacefaring continues to present daunting technical challenges. Moreover, space operations differ so radically from operations on earth that highly specialized training, recurring education, and career management are required to develop experts.

Space weaponization is inevitable. Wherever humankind goes weapons follow. There are genuine reasons for not weaponizing space, but they fail to take into account the imperatives that often drive nations in ways that are beyond rational thought. When weapons will be placed in space is uncertain, but pragmatists must assume that it will happen—and act accordingly.

Not a Single Dimension

Spacepower directly affects other instruments of national power and increasingly shapes the daily lives of ordinary people. Its military importance is growing because it forms a global informational infrastructure that the armed forces of advanced nations increasingly rely on. In the future, spacepower will likely include counterspace weapons and systems that attack terrestrial targets. Space will become a place to pre-position combat power for immediate execution against terrestrial targets anywhere around the globe.

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Military Uses of Space

Attributes of Space Operations

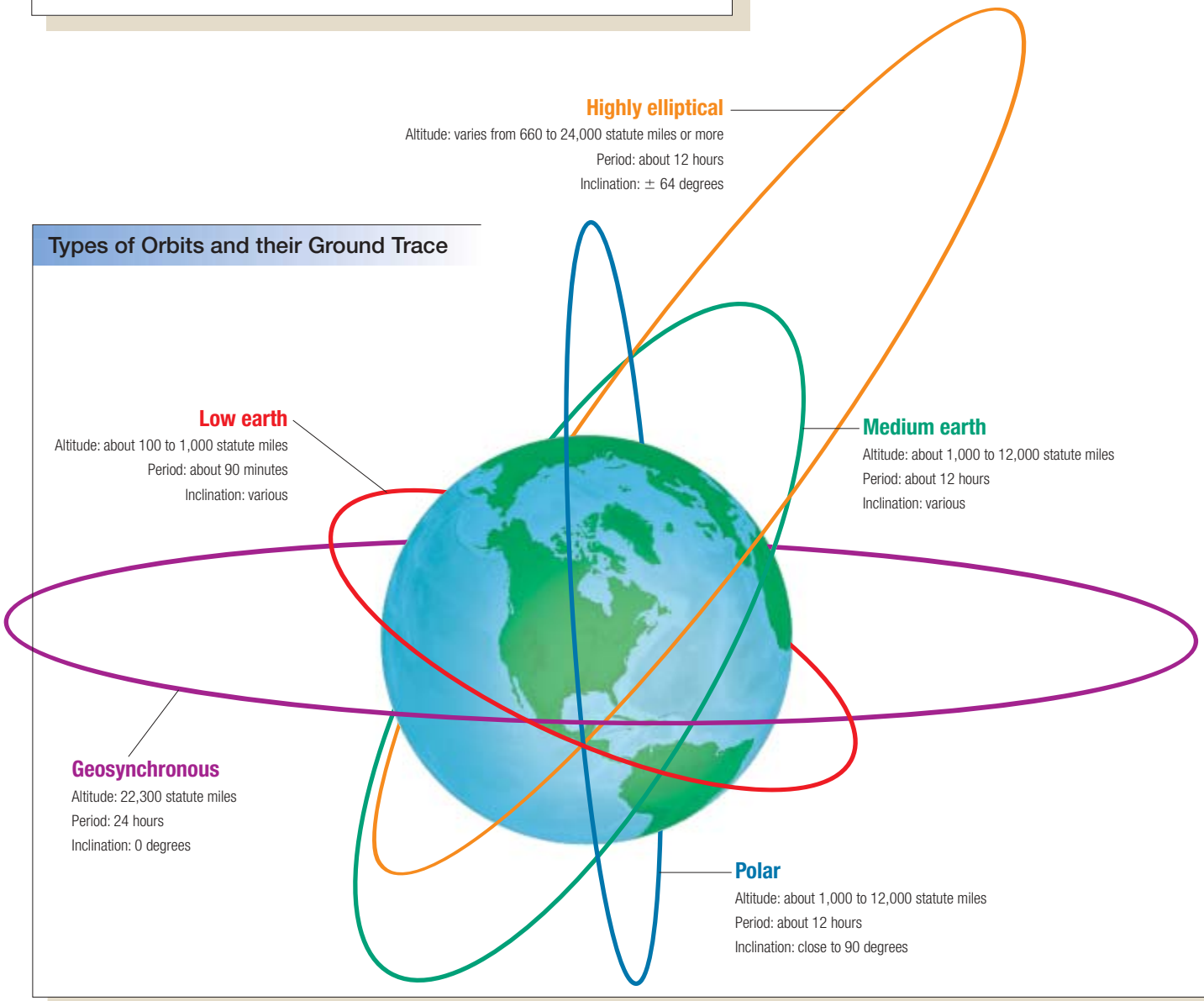
ADVANTAGES

- Global access
  - – High vantage point
  - – No overflight restrictions
- Longevity of systems
- Persistent operations

LIMITATIONS

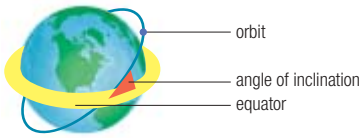
- Inhospitable environment
  - – Difficult and costly to access
  - – Very difficult to maintain or reconfigure systems
- Predictable orbits
  - – May be vulnerable to attack

Types of Orbits and their Ground Trace

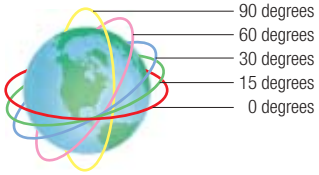


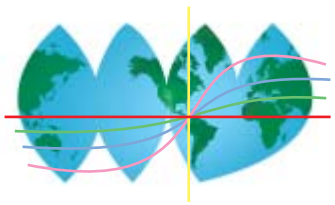
Inclination of Satellites

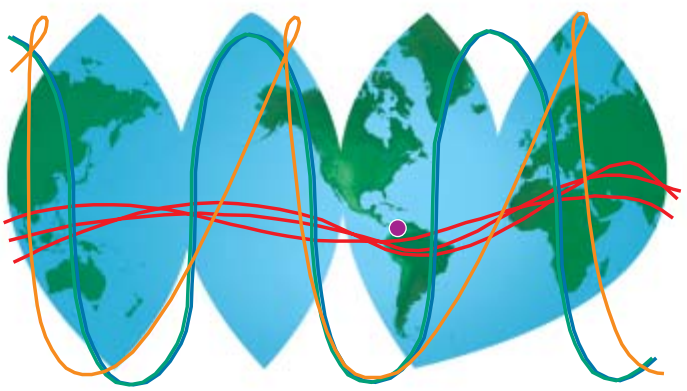
• Angle of orbit relative to the equator



• Comparison of inclination

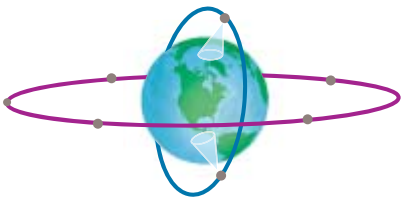






Uses of Satellites

• Intelligence and Weather

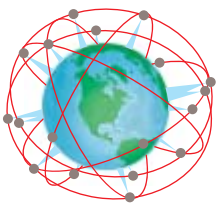


• Reconnaissance

• Surveillance

• Communications

• Navigation



Meteorological satellite atop launch vehicle.

Lockheed Martin

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Despite evidence to the contrary, many persist in arguing that spacepower is not separate and distinct from airpower on the theoretical basis that it delivers similar products, as if aircraft can do what spacecraft do. This is not the case. Aircraft cannot survey more than 80 percent of the earth with three vehicles or fly over denied airspace. A few satellites can provide persistent capabilities worldwide. While the global positioning system uses only 24 satellites in its nominal constellation, it has created the first global utility. Some satellites perform intelligence gathering missions similar to those of aircraft, but reconnaissance planes loiter over theater-specific areas while reconnaissance satellites transit the globe in minutes, collecting and disseminating data in virtually every theater along the way. Moreover, basic differences create professional mindsets. Airmen have a theater perspective and space professionals have a global view, as evidenced by the fact that airpower is controlled by theater-level joint force air component commanders while space-based assets are controlled globally by commanders inside the continental United States.

The aviation community has repeatedly tried to make aircraft that can do what spacecraft do. There have been many efforts to develop a space plane, but none has become operational, in part because of technical problems, but mostly because no one could justify the great expense of making an aircraft to duplicate satellite capabilities, with the exception of serving as a reusable spacelift and recovery vehicle. Some argue that America needs a combat-capable space plane to deliver ordnance more rapidly than aircraft without forward bases in the combat zone. These are compelling ends, but justifying the means will likely be as difficult today as it was at the height of the Cold War when such a vehicle was first postulated.

An Independent Theory

A spacepower theory can serve political and military practitioners with a framework for assessing space issues and guide related decisionmaking. It must be rooted in broader theories of statecraft and warfare. Students of spacepower should build, in particular, on *The Art of War* by Sun Tzu and *On War* by Carl von Clausewitz. The former describes the nature of statecraft and war in a world where states constantly compete.[1] The latter work, while often misinterpreted, captures the premise of armed conflict: "War is nothing but the continuation of policy with other means . . . the political object is the goal, war is the means of reaching it, and the means can never be considered in isolation from their purpose."[2] Simply put, spacepower does something in space to support policy. These classic sources and an appreciation of the ten propositions outlined above set the stage for a working theory.

The military uses of space provide global capabilities to assist in achieving political and military objectives. This is an independent dimension of power that can be used alone or in concert with other forms of power to achieve desired ends. Space is an expanse where humans place systems to resolve problems. It begins above the surface of the earth at the lowest altitude at which a

satellite can sustain a circular orbit (some 93 miles) and reaches to infinity. Eventually, man's interests may extend beyond near-earth space. Military spacepower is likely to be used to protect those interests. Someday in the future, populations and political entities may migrate into space as well. But for now, humans live on the surface of the earth, and spacepower in this context refers to terrestrial struggles.

The reason for going into near-earth space is gaining access to regions where terrestrial forces either cannot go or loiter as economically as some satellites. A relatively small number of similar satellites extended in orbital space can survey the entire surface of the earth, which gives space-based constellations the ability to perform missions on a global scale. In the opening years of the 21st century, space missions are primarily informational—by providing command, control, communications, and computer support as well as intelligence, surveillance, and reconnaissance support to terrestrial forces. Land, sea, and air forces also perform such missions, but only space systems (and some terrestrial communications networks) perform them around the globe all the time. These space networks create a global informational infrastructure that links expeditionary forces deployed anywhere in the world and connects them with their leaders at home.

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Space-based weapons will not only be used to gain control of space in the future, but against targets on land, at sea, and in the air. With a sustained commitment to technological advancement and investment of resources, space will provide a vantage point from which to observe, support, and influence human events. But space systems will require a vigorous defense.

Satellite and microwave commercial news vans.

U.S. Navy (Dick Cole)

Space Control

The first and most enduring mission of space forces is to gain relative space control over enemies, enabling the space offensive while protecting friendly forces from hostile space actions. This requires continuous situational awareness about what is happening and acting to ensure friendly access to extraterrestrial capabilities while denying the same to any enemy. Control has both defensive and offensive components.

Defensive control must ensure that friendly forces and their political leaders can continue to exploit space. It is necessary to support theater operations where combat is underway and to continue observing activities in all other theaters to assess additional threats requiring diplomatic or military intervention. Space control also enables a state to sustain such services from space as communications and global positioning data, upon which users in all theaters are increasingly reliant. At the same time, commercial assets require protection. Ideally, all satellites should be hardened against attack, but commercial investors are reluctant to spend the money, placing a burden on defense planners to defend commercial systems, which are important to domestic and allied economies.

Enemy counterspace weapons could rapidly destroy space systems. Therefore it is vital to acquire the ability to quickly find, fix, track, target, and destroy counterspace weapons. Such systems may reside on land, at sea, in the air, or in space. It is equally imperative to restore lost satellite capabilities in orbit before their loss affects political, economic, and military operations. Restoration may be achieved by activating in-orbit spares, leasing commercial services, launching new satellites to replace capabilities lost through attrition, or gaining access to allied services. The ability to repair or replace lost satellite ground control systems is also essential, and methods may include transferring ground control responsibility to another location (either fixed or mobile), leasing commercial support, or obtaining ground assistance from allies.

Offensively, space control does not have to be total to be effective. An enemy may have satellites that do not especially affect its warfighting capability. Circumstances and strategy will dictate the degree of offensive space control required. Considerations will be the time and place where control must be gained, how rapidly it is needed, the number of satellites or

Saddam International Airport.

Space Imaging

ground control targets to be negated, how long control must be sustained, and the desired level and reversibility of negation (deception, disruption, denial, degradation, and destruction).

Satellites are global assets whose value is proportional to the interests of their state or nonstate owners. It may be politically untenable to permanently damage an unfriendly vehicle for various reasons. For example, although an imagery satellite may threaten to disclose friendly troop movements in one region, it might perform treaty verification or other missions on the opposite side of the globe. In many scenarios, offensive space control might best be limited to localized and temporary effects.

One way of denying access to space is destroying hostile launch facilities. But an enemy may acquire space lift from other states. Thus the best way of denying space support is negating the satellites directly. Though some satellites may be particularly susceptible to the destruction of ground stations, others may degrade gracefully in the absence of ground control. An enemy could use mobile ground stations for tactically critical space systems that need frequent control from the ground. This fact not only makes targeting ground stations more difficult—it highlights the need to negate unfriendly satellites in orbit. It is also possible to attack space use by jamming or spoofing receivers, which has the benefit of localized and temporary effects. A combination of attacks on all segments of a system—ground stations, satellites in orbit, and user equipment—as well as on their linkages may sometimes be needed to achieve the desired effect.

commanders can allow greater concentrations in theater because space-based assets act as a kind of global sentry

Control will be complicated if an enemy uses launch facilities, satellites, or ground control systems provided by commercial firms, international consortia, or allies. Diplomatic efforts are needed to eliminate third-party support, but friendly forces must be ready to expand the conflict by striking support wherever it originates. If diplomacy fails, and policy does not allow striking third-party targets, an enemy has a sanctuary it will likely exploit.

Situational Awareness

In an era of precision targeting, situational awareness must be equally precise. Bombs are only as accurate as the coordinates available to planners, warfighters, and munitions themselves. Precision targeting is well understood, but the demand for precision intelligence, surveillance, and reconnaissance is not.

Multiple intelligence, surveillance, and reconnaissance sensors in all media characterize the modern battlespace. Some collect signal intelligence while others gather photoreconnaissance data and still others accumulate radar information. Sensors and their operators not only identify targets but also determine exact coordinates. The precision of sensors varies, but airborne devices can be more effective than space-based sensors because satellites are usually farther from targets and satellites in low orbits have relatively short dwell times. Satellites in higher orbits are more distant and generally less able to precisely refine coordinates. Also, satellite sensors degrade over time and there is no effort to keep them in prime condition. Finally, given the relatively small number of satellites in low-earth orbit, continuous coverage is currently impossible. And though aircraft have several distinct advantages over spacecraft in collecting information within theater, data gathered from space is critical.

Space-derived assets offer the first look at the battlespace and help identify targets before they enter the area. As a rule of thumb, intelligence, surveillance, and reconnaissance derived from space are useful in finding 80 percent of targets and can determine their location with 80 percent of the accuracy required for precision strikes. With this information, civilian and military leaders can make decisions on employing forces. The initial look from space may suffice in some cases, but terrestrial assets are usually needed. During combat, space-based intelligence, surveillance, and reconnaissance sensors continue to provide data, filling gaps in theater coverage. Moreover, they can also cue terrestrially-based sensors, as happened during Desert Storm, when missile warning satellites directed Patriot batteries to Scud missile launches.

Perhaps most important, in war and peace, spacepower provides an 80-percent first look on a global scale. It allows analysts to watch the world and report factors that give the flexibility to political and military leaders to employ terrestrial forces more expeditiously and confidently. Spacepower literally watches the backs of forces to make sure no threat is sneaking up behind them. Thus commanders can allow greater concentrations in theater because space-based assets act as a kind of global sentry. Space systems have unimpeded access, and relatively few assets are required to sustain worldwide intelligence, surveillance, and reconnaissance missions.

By increasing the number of low-earth orbiting sensors, improving their capabilities, and developing the means to maintain them, that 80 percent rule of thumb will approach 100 percent. But although space systems will become more capable, they will not replace terrestrial forms of inteligence collection and other functions. Aerial reconnaissance did not obviate the need for land and sea forces to conduct reconnaissance and space assets will not totally usurp such missions.

The Proverbial Toolbox

The synergism created by spacepower and other military forces yields new capabilities. Its continuous global coverage is a new contribution to warfare. The various command, control, communications, computers, intelligence, surveillance, and reconnaissance capabilities—weather observation, missile warning, and navigation broadcasts—provide a distinct informational edge to the military. This advantage will evaporate as other actors on the world stage develop, lease, or borrow similar capabilities.

Landpower, seapower, airpower, and spacepower bring different capabilities to the table. The Armed Forces train in highly specialized ways, the objective being to dominate operations in their respective media. Operations in each dimension require centralized control in coordination with each service to ensure optimum management of resources for joint warfare.

It is a fallacy that airpower missions will eventually migrate to space. This presumes that joint commanders would trade highly flexible organic airpower for less flexible and capable space systems that others would likely manage as global assets. Economic considerations may lead to such a compromise, but a more prudent approach would be to develop robust spacepower capabilities that complement landpower, seapower, and airpower assets. The difference between space and terrestrial systems is that the former provide global access and presence. Terrestrial systems must be developed as theater assets to fill voids in coverage and offer more flexible and precise intelligence, surveillance, and reconnaissance as well as strike capabilities.

Assuming that space systems will eventually be able to target any location on earth with conventional bombs or other weapons does not mean they should simply replace aircraft for such missions. Space operations are expensive, and economic considerations alone will likely require air delivery of many munitions. Exceptions include times when cost is not a consideration, such as combat in denied areas, situations when aircraft cannot quickly respond, targets best engaged by specialized weapons delivered from space, or conditions where surprise is vital.

While some overlap exists between spacepower and other dimensions of military power, this is a prudent investment. Just as bombers, submarines, and missiles were designed to prevent an enemy from gaining a significant advantage if it countered one leg of the triad during the Cold War, redundancy today prevents an enemy advantage should space-based systems or terrestrial forces be countered. Some adjustments in force structures will be required as space capabilities become stronger, but no mission should be moved entirely to space.

Combined Arms

In peacetime, spacepower assets monitor the globe, helping to identify and characterize potential threats. When a danger arises, political and military leaders can send terrestrially-based sensors into the area for a closer look. If hostilities break out, space forces will gain the degree of space control needed and help in providing intelligence, surveillance, and reconnaissance and strike capabilities. They must watch the rest of the world, looking for tipoffs, warnings, and indicators of other threats in any theater.

Force application from space will take many forms, but it seems likely that space-based weapons will fill specific niches, ideal for some missions during certain phases of operations. No claim is made that spacepower by itself can be decisive in conventional warfare, but it may help set the conditions for victory under some circumstances. Conversely, if spacepower forces are defeated, that could turn the tide against friendly forces. There may be certain forms of limited warfare wherein information gleaned from space or strikes delivered from space may achieve the political and military aims of an operation.

Analyzing spacepower reveals that air and space—or airpower and spacepower—differ. It also provides a foundation for a working theory of spacepower, which supports the principles of statecraft and warfare. Moreover, it complements rather than competes with other dimensions of military power. The Nation has much unfinished business in building spacepower, especially in matching the ambitious vision presented above. As the Air Force matures in its role as the executive agent for military-related spacepower, it should be expected to promulgate spacepower theory and doctrine separate and distinct from its treatment of airpower. JFQ

NOTES

[1] Sun Tzu, *The Art of War,* translated by Ralph D. Sawyer (Boulder, Colo.: Westview Press, 1994).

[2] Carl von Clausewitz, *On War,* edited and translated by Michael Howard and Peter Paret (Princeton: Princeton University Press, 1976), pp. 69, 87.